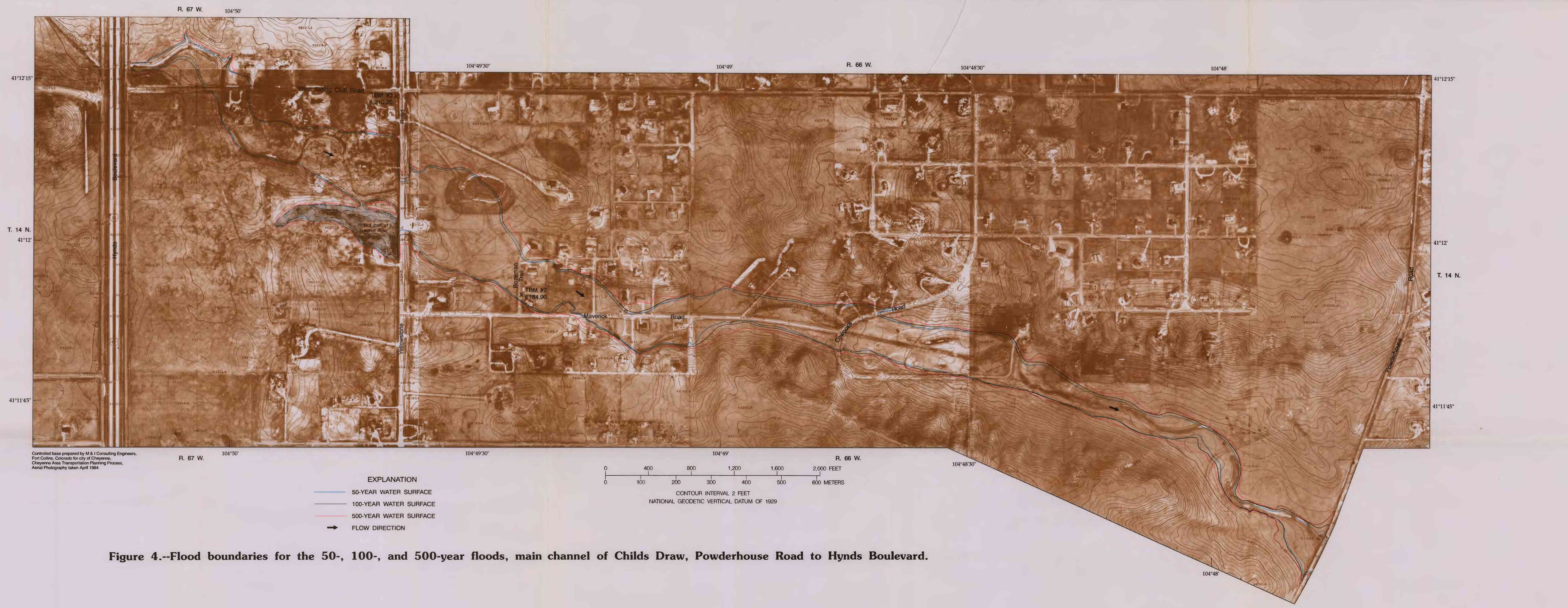

Figure 4.--Flood boundaries for the 50-, 100-, and 500-year floods, main channel of Childs Draw, Powderhouse Road to Hynds Boulevard.

Vertical control for the survey was obtained from the City of Cheyenne control monument "Ridge", located in the NW1/4 NW1/4 sec. 22, T. 14 N., R. 66 W., in the Holland-Smith subdivision (fig. 1). The station is a 2 inch-diameter brass tablet set in a concrete monument at an elevation of 6,141.38 feet above sea level. Three temporary benchmarks (TBM) were established during the course of the survey: (1) iron pipe, set in the northwest corner of Glencoe Drive and College Drive, elevation 6,059.48 feet; (2) Spike in a cutoff telephone pole, approximately 10 feet east of Bozeman Trail and 240 feet north of Maverick Road, elevation 6,184.90 feet; and (3) Wyoming State Highway right-of-way marker at the southwest corner of Yellowstone Road and West Riding Club Road, elevation 6,210.25 feet.

MAGNITUDE AND FREQUENCY OF FLOODS

Design discharges for the 50-, 100-, and 500-year floods at selected locations along the main channel and tributary of Childs Draw were computed using empirical equations developed for streams in the Plains region of Wyoming (Lowham, 1988). Drainage area and slope of subbasins were determined from U.S. Geological Survey topographic maps Cheyenne North and Round Top Lake (scale 1:24,000). Subbasins depicted in figure 1 were defined by roadway intersections with the channel, in addition to the confluence of the tributary with the main channel. Computed discharges, using Lowham's equations, are shown in table 1.

Unit discharges for the August 1, 1985 flood ranged from 465 to 4,020 cubic feet per second per square mile on Dry Creek, just south of Childs Draw (Druse and others, 1986). In comparison, unit discharges associated with the computed discharges for the 50-, 100-, and 500-year floods on Childs Draw and tributary used in this study are listed in table 2.

Table 1.--*Subbasin characteristics and design discharges for the 50-, 100-, and 500-year floods, Childs Draw and tributary near Cheyenne, Wyoming*

Subbasin (fig. 1)	Drainage area (square miles)	Basin slope (feet per mile)	Discharge (cubic feet per second) for selected return period (years)		
			50	100	500
I	2.45	254	735	853	1,780
I,II	4.31	257	990	1,140	2,380
III	2.52	226	724	841	1,750
I-V	9.07	252	1,260	1,630	3,360
I-VI	10.3	244	1,320	1,710	3,530

Table 2.--*Subbasin drainage areas and unit discharges for the 50-, 100-, and 500-year floods, Childs Draw and tributary near Cheyenne, Wyoming*

Subbasin (fig. 1)	Drainage area (square miles)	Unit discharges (cubic feet per second per square mile) for selected return period (years)		
		50	100	500
I	2.45	300	348	727
I,II	4.31	230	265	552
III	2.52	287	334	694
I-V	9.07	139	180	370
I-VI	10.3	128	166	343

HYDRAULIC ANALYSIS AND WATER-SURFACE PROFILES

Hydraulic computations for flow through culverts, over roads, or through open channels were used as appropriate to calculate the elevations of the 50-, 100-, and 500-year floods. Methods to route flow through culverts are described by Bodhaine (1968). Water-surface elevations for flow over roadways were determined using procedures described by Hulsing (1967). Water-surface elevations in open channels were computed using the Water Surface Profile (WSPRO) model developed by Shearman and others (1986). Data were input into the hydraulic model using instructions from the Users Manual for WSPRO (Shearman, 1990).

Descriptions of approach cross sections, downstream cross sections, and barrel geometry for culverts were obtained during the onsite survey at each culvert site. Culvert barrels were assumed to be free of debris at all flow levels when stage-discharge ratings were computed. Flow conditions through the culverts were determined on the basis of culvert slope and headwater and tailwater elevations. Flow over roadways was assumed to be critical at the crown of the roadway. Flow submergence was not considered in these calculations.

The step-backwater method used by WSPRO to compute the open channel water-surface profiles required that a series of cross sections be surveyed across the valley to define the hydraulic characteristics along the channel. Each cross-section location was selected to represent the hydraulic characteristics of a particular reach and was surveyed to define the cross-section shape. When long distances between cross sections resulted in computed critical or supercritical flows without sufficient physical basis, template cross sections were used. These templates represented surveyed cross sections that had been moved upstream or downstream within the model from their actual surveyed location and were adjusted for channel slope. Templates were inserted between surveyed cross sections so that the model would continue to route water upstream, but were not used to define specific water-surface elevations for the flood discharges. Water-surface elevations are shown only for the surveyed cross sections.

Storage effects from ponding upstream of road embankments were not considered in this study, because the WSPRO model is limited to conditions of one-dimensional, gradually varied, steady-state flow. Thus, discharges for the 50-, 100-, and 500-year floods were assumed not to be attenuated by storage within the study reach.

The types of hydraulic computations used to determine water-surface elevations are discussed below for the following reaches within the main channel and tributary of Childs Draw. Computed flood boundaries (plan view) for the 50-, 100-, and 500-year floods are shown in figures 2, 4, and 6.

Childs Draw Main Channel, Eastern Edge of Study Reach to Powderhouse Road

Flood boundaries for the 50-, 100-, and 500-year floods are shown in figure 2; water-surface profiles from the eastern edge of the study area to Powderhouse Road are shown in figure 3.

East Edge of Section 15 (T. 14 N, R. 66 W.) to Braehill Road. The shape, slope, and roughness of the channel determined the hydraulics of the design floods. Water-surface elevations were determined using WSPRO (Shearman and others, 1986). Flow over Oasis Street was routed as flow over a vertical contraction in the channel rather than flow over a roadway.

Braehill Road culvert and roadway. The stage-discharge rating curve for this location was developed using a combined analysis of flow over the centerline of the gravel roadway and flow through a corrugated metal pipe culvert. Flow over the roadway was routed using methods described by Hulsing (1967), while flow through the culvert was routed using methods described by Bodhaine (1968).

Braehill Road to Columbia Drive. Because the shape, roughness, and slope of the channel between Braehill Road and Columbia Drive determined the hydraulics of flow, WSPRO was used to compute the water-surface elevations of the floods.

Columbia Drive roadway. Flow over the centerline of this gravel roadway was routed using methods described by Hulsing (1967).

Columbia Drive to College Drive. WSPRO (Shearman and others, 1986) was used to determine the hydraulics of this section and compute the water-surface elevations of the floods. Several headcuts, sidecuts, scour holes in the channel bottom, and an old roadbed influenced the shape, roughness, and slope of the channel.

College Drive roadway and culverts. The stage-discharge rating curve was computed by combining the flow over the centerline of the roadway and the flow through four corrugated-metal-pipe culverts. Methods described by Bodhaine (1968) were used to develop the stage-discharge ratings for the culverts, while procedures described by Hulsing (1967) were used to route flow over the paved roadway.

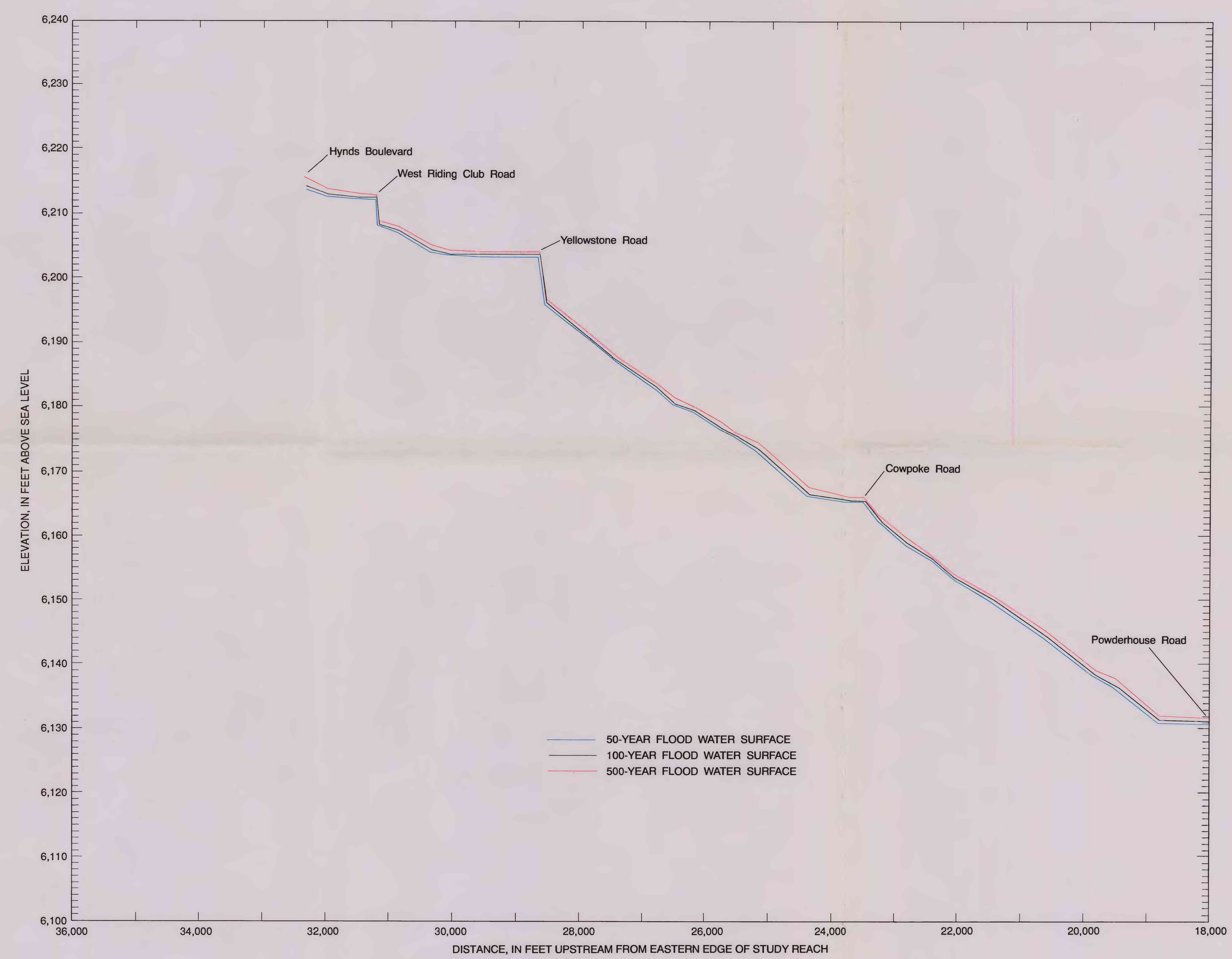

Figure 5.--Water-surface profiles for the 50-, 100-, and 500-year floods, main channel of Childs Draw, Powderhouse Road to Hynds Boulevard.

FLOOD BOUNDARIES AND WATER-SURFACE PROFILES FOR THE COMPUTED 50-, 100-, AND 500-YEAR FLOODS, CHILDS DRAW AND TRIBUTARY NEAR CHEYENNE, WYOMING, AUGUST 1991

By
George F. Ritz
1993

George F. Ritz, 1993, Flood boundaries and water-surface profiles for the computed 50-, 100-, and 500-year floods, Childs Draw and tributary near Cheyenne, Wyoming, August 1991